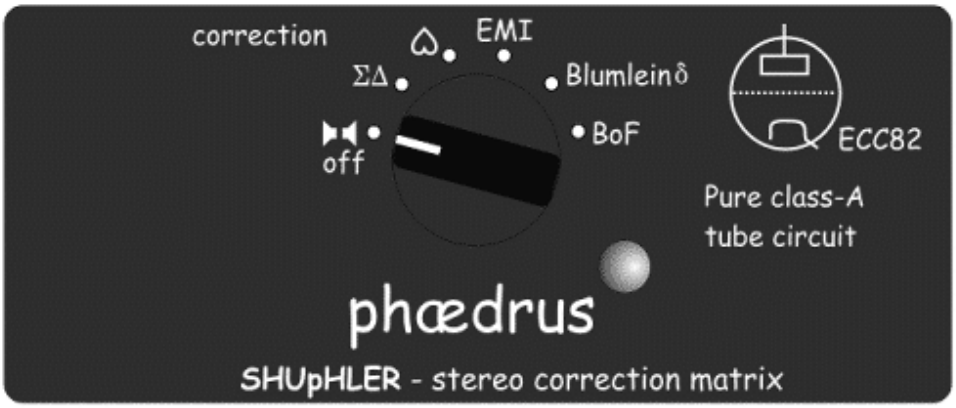
User Manual for

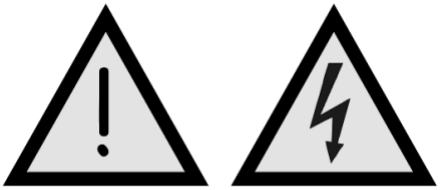
phædrus

phædrus-audio.com



SHUpHLER – stereo correction matrix

This manual is also available as a pdf download, Go to: www.phaedrus-audio.com



RISK OF ELECTRIC SHOCK
DO NOT OPEN!

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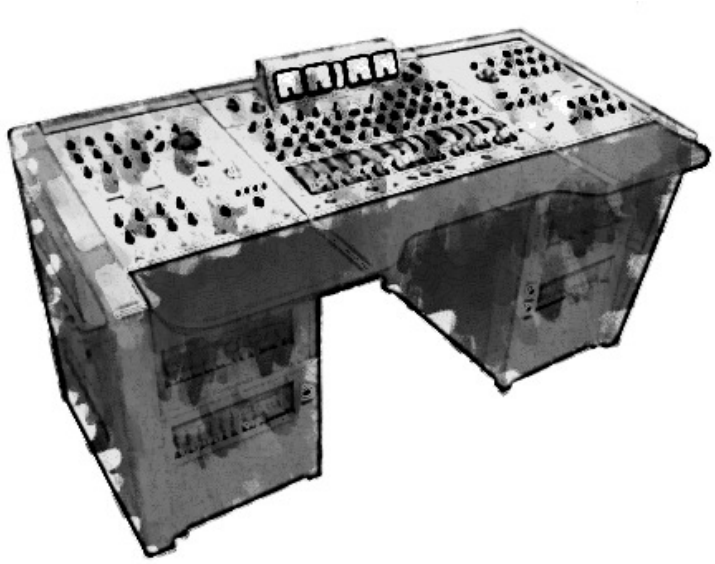
Preface – About Phædrus Audio

phædrus
phædrus-audio.com

Phædrus Audio was formed to design, manufacture and sell high-quality products for the professional and semi-professional audio market. Phædrus Audio's founders remain inspired by the music and the recording practices of the fifties and sixties, and are motivated to re-establish the values of the great audio-technology legends of the past with their ideals of transparency, hand-built quality, and serviceability. Using modern manufacturing techniques and the benefits of modern component technology, Phædrus Audio's aim is to reproduce the quality and character of classic equipment but in a modern, highly reliable, and cost-effective way.

Chapter 1 - Background

The Phædrus Audio products came about because two, recording musicians wanted to own a "classic" console from the nineteen-sixties. Ideally a famous EMI, REDD, all valve (vacuum tube) mixer used to record The Beatles.



But those desks make a collection of hen's teeth look positively prosaic - as well as cheap! So, we set about researching with the idea of producing a replica console.

In order to do this, first it was necessary to have a design for the amplifier modules around which the mixers of this vintage are organised.

In the famous EMI REDD mixers, these amplifiers were either the German manufactured V72(S) amplifiers or the, very rare, EMI built, REDD.47 amplifiers.

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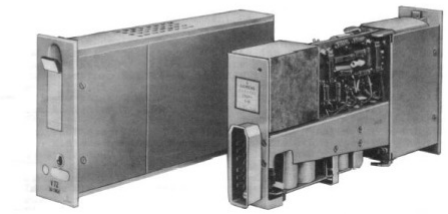
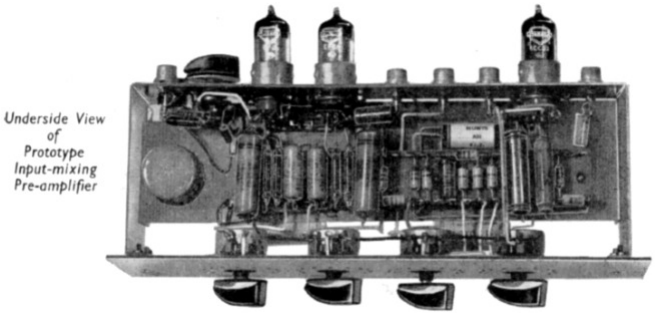
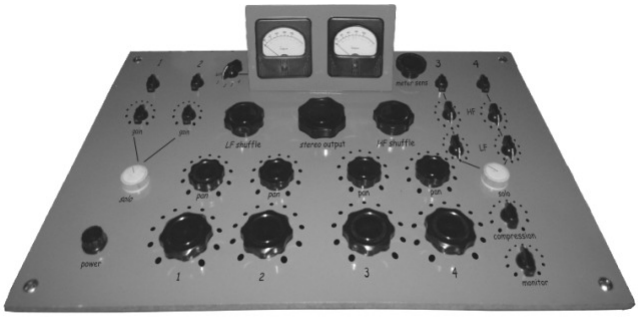


V72 and REDD.47 modular amplifiers

Ironically, despite the fact that many more V72 amplifiers exist than do REDD.47s, the EF804 valves which the German amplifiers use are no longer in current production and are becoming very expensive: whereas the EF86 and ECC88 (E88CC) valves employed in the REDD amplifiers remain in production and are widely available. So, a new amplifier, designed from the common source of Mullard's reference audio designs, and thereby sharing a common heritage with the REDD amplifiers, was developed. We called this amplifier the Phaedrus "PHILHARMONIC" (literally, *music loving*). This PHILHARMONIC amplifier forms the heart of the Phædrus Audio LONDON Mark II console. The PHILHARMONIC amplifier circuit is described in detail below in section *Circuit descriptions*.



Mullard published many reference designs which were used by EMI in developing the REDD amplifiers. At Phædrus Audio, we went back to these same references to develop our products.



The prototype London Console (Mark II)

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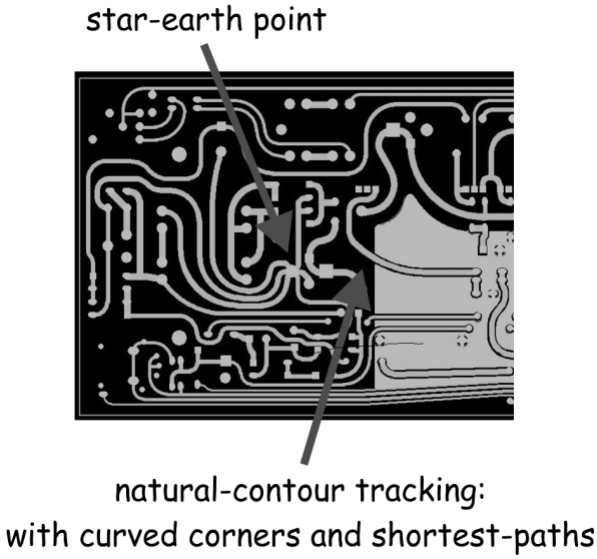
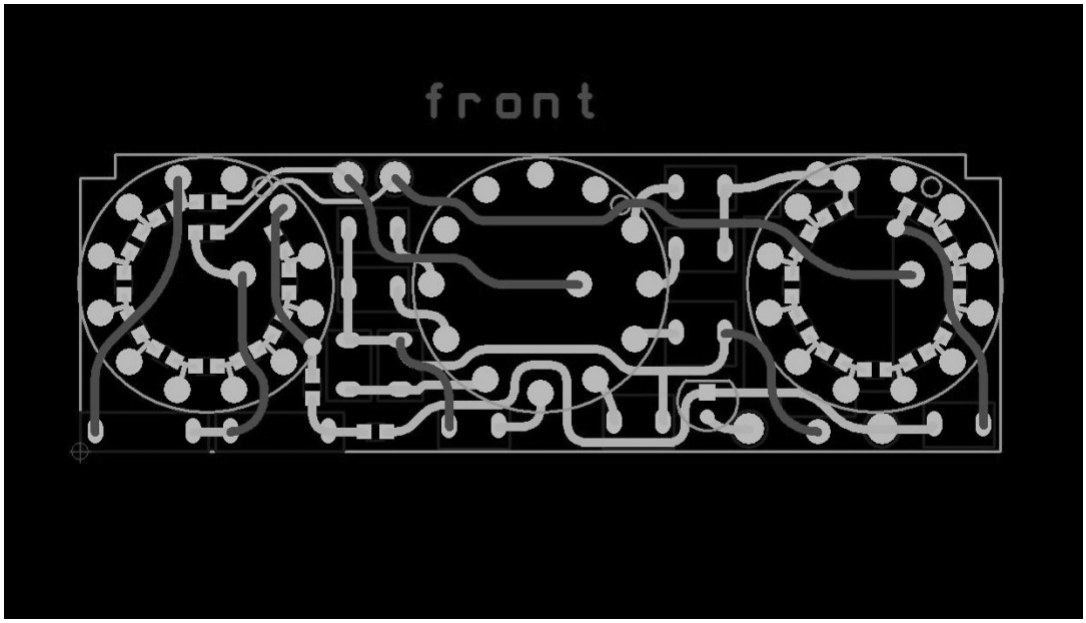
Construction - or star earths (grounds) and curly tracks

Given their vintage, the V72 amplifiers and the REDD.47 amplifiers were built on a metal chassis, with the components hardwired onto tag-strips. Although Phœdrus Audio equipment uses printed circuit boards to ensure consistent performance and reliability, the equipment follows "classic" practices such as star earths and "natural contour" tracking, just like hook-up wire.

Every Phœdrus Audio product is hand assembled and individually tested. A test pro-forma is provided with every unit. Phœdrus Audio offer comprehensive service for products both inside and outside of their warranty period.





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Chapter 2 - Warranty and Service

Please register your purchase with Phaedrus Audio at www.phaedrus-audio/registration.htm . This will simplify service & repair should you need this service. Your name will be placed on our mailing list (unless otherwise requested) for future updates and new product announcements.

Service

If you experience a problem with a Phædrus Audio Ltd. product, contact:

support@phaedrus-audio.com
TELEPHONE: +44 207 193 4609
Skype ID: phaedrusaudio

We will diagnose the problem remotely and advise you of the warranty status. If a repair or replacement is required, we will issue a Return Merchandise Authorization (RMA) number and tell you where to send the unit to be repaired. You MUST have an RMA number before you return the equipment to Phædrus Audio Ltd.'s support service. Be sure to write RMA number on outside of shipping box and to include your name, address, phone number, a copy of original sales invoice and a detailed description of the problem. Phædrus Audio Ltd. will not accept responsibility for loss or damage in shipping or for equipment returned without valid paperwork and/or a valid RMA number. Remember, warranty is void if product serial numbers have been removed or altered, or if the product has been damaged by abuse, accident or unauthorized modification and/or repair (see Phædrus Audio Ltd. Limited Warranty for details). There are no user serviceable parts inside.

PLEASE RETAIN YOUR SALES RECEIPT. IT IS YOUR PROOF OF PURCHASE COVERING YOUR LIMITED WARRANTY. LIMITED WARRANTY IS VOID WITHOUT SUCH PROOF OF PURCHASE.

Phædrus Audio Ltd.'s Limited Warranty

This limited warranty is valid only if you purchased the product from Phædrus Audio Ltd. of from a Phædrus Audio authorized dealer in the country of purchase: a list of authorized dealers can be found on Phædrus Audio website www.phaedrus-audio.com, or by contacting sales@phaedrus-audio.com. Phædrus Audio Ltd. warrants that the equipment it manufactures shall be free from defects in material and workmanship for a period of one (1) year from the original date of purchase; unless a longer minimum warranty period is mandated by applicable local laws. If equipment fails due to such defects within this period, Phædrus Audio will, at its option, repair or provide a replacement for the defective part or product. Valves (vacuum tubes) are excluded from the one-year warranty, but are warranted for 90 days from day of purchase. This warranty does not extend to any Phædrus Audio Ltd. product that has been damaged or rendered defective as a result of: accident, misuse, or abuse; or by the use of parts not manufactured or supplied by Phædrus Audio Ltd.; or by unauthorized modification or attempted repair to the product; or by acts of God/Nature (accident, fire, flood, etc) or any other condition that is beyond the control of Phædrus Audio Ltd. There are no user serviceable parts inside. This limited warranty is invalid if the factory-applied serial number has been altered or removed from the product. This limited warranty is extended exclusively to the original buyer (customer of Phædrus Audio Ltd., or authorized retail dealer) and is not transferable to anyone who may subsequently purchase the product. No other person (retail dealer, etc.) shall be entitled to give any warranty promise on behalf of Phædrus Audio Ltd. Phædrus Audio Ltd. makes no other warranties, expressed or implied, of merchantability, fitness for a particular purpose or otherwise. Phædrus Audio Ltd. liability is limited to repair or replacement by Phædrus Audio Ltd., at its sole discretion and, in no event, will Phædrus Audio Ltd. be liable for any direct, indirect, special, incremental or consequential damages resulting from any defect in the product, including lost profits, damage to property and, to the extent permitted by law, damage for personal injury, even if Phædrus Audio Ltd. has been advised of the possibilities of such damages.

Shipping Charges

For any hardware defects experienced by the customer while the product is under warranty, Phædrus Audio Ltd. will incur the shipping cost to the customer and the customer is responsible for the shipping costs to Phædrus Audio Ltd's designated after-sales service office. For defective products that are out of warranty the customer is responsible for all shipping costs to and from Phædrus Audio Ltd's designated after-sales service office.

Extended warranty and out-of-warranty services

Various services are available from Phædrus Audio Ltd. These include repair services for equipment once the warranty period has expired, and the ability to extend the warranty period. These are:

SHUpHLER-REP - Repair of a defective SHUPHLER equaliser, charged at a flat-rate
SHUpHLER-MISEAJOUR - Mise à jour for SHUPHLER*
PHAE-EXTWARR - Extends standard warranty (see above) by a further year**

* A mise à jour service includes a complete inspection, re-valve (re-tube) and the implementation of any engineering updates as well as a re-test to performance specification.
** If extended warranty is ordered after the initial warranty has expired then the intervening period is charged without exception.

Please contact your dealer or Phædrus Audio Ltd. for current prices.

Warranty service conditions are subject to change without notice. For the latest warranty terms and conditions and additional information regarding Phædrus Audio Ltd. limited warranty, please see complete details online at www.phaedrus-audio.com .

Chapter 3 - Safety

General

Before using any piece of equipment manufactured by Phædrus Audio Ltd., be sure carefully to read the applicable items of these operating instructions and the safety suggestions. Keep them for future reference. Follow the warnings indicated on the unit, as well as in the operating instructions.

Selection of PSU

Suitable PSUs for the Phædrus Audio Ltd. products are available as line items from Phædrus Audio.

They are:

PHAE-PSU(110) - 110V mains plugtop PSU: plug is North American type.
PHAE-PSU(220Euro) - 220V mains plugtop PSU; plug is European type
PHAE-PSU(220UK) - 220V mains plugtop PSU; plug is 3 pin 13 AMP, British type

A 12V AC supply is required for the Phædrus Audio SHUPHLER. A direct current (DC) supply is NOT suitable and will damage the unit. If a supply is sourced elsewhere than from Phædrus Audio, it must have the following specifications:

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- 12V AC, 12 Watt supply or greater (> or = 1000mA supply current)
- Must be suitable for connection to the appropriate mains voltage
- Must be Class-II, double-insulated
- Must have 30% regulation or better
- Must contain one-shot thermal fuses, resettable fuses, or Polyswitches for over-current protection.

UK and Euro units should comply with **EN 60950-1** and **CE** requirements and **only PSUs with UL and CSA** approvals should be provided on North American units. Units supplied to other countries should be verified to comply with the relevant standards which obtain in those territories.

User Access & Servicing

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Phædrus Audio equipment employs thermionic valve (vacuum-tube) technology and employs hazardous voltages for the high-tension supplies. THE USER SHOULD NOT ATTEMPT TO SERVICE THE UNIT. ALL SERVICING SHOULD BE REFERRED TO QUALIFIED SERVICE PERSONNEL OR FACTORY ONLY.

Phædrus Audio products should NEVER be connected to the external power supply or in any other way energised when the case is opened and/or the circuit board is accessible.

Ground (earth) issues

Phædrus Audio Ltd.'s products are all powered by external (12V AC) power supplies which should be double insulated, class-II types (see above). It should therefore be appreciated that,

A CONNECTION TO EITHER THE PHAB, the PHAME, SHUPHLER of the PHI product CAN NEVER BE RELIED UPON PROVIDE A PROTECTIVE OR SAFETY EARTH (GROUND). This advice obtains IRRESPECTIVE OF THE SETTINGS OF ANY "EARTH OR GROUND LIFT" SWITCHES.

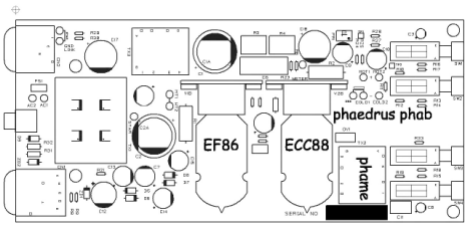
General Safety Instructions

- Do not operate Phædrus Audio equipment near any source of water or in excessively moist environments.
- Keep your Phædrus Audio equipment away from babies, children and pets.
- Do not let objects do not fall, or liquids be spilled, into the enclosure.
- Situate the Phædrus Audio equipment away from heat sources or other equipment that produce heat.
- Ensure Phædrus Audio equipment has adequate ventilation. Improper ventilation will cause overheating, and can damage the equipment.
- When cleaning Phædrus Audio equipment, remove all connections to the unit; including power and gently wipe with a clean lint-free cloth; if necessary, gently moistened with lukewarm or distilled water. Use a dry lint-free cloth to remove any remaining moisture. NEVER use aerosol sprays, solvents, or abrasives on Phædrus Audio equipment.
- Phædrus Audio equipment should be serviced by qualified service personnel or returned to Phædrus Audio Ltd. when: an object (or objects) have fallen into the enclosure; or liquid has fallen into, or been spilled into the unit; or the unit has been exposed to rain or high

humidity; or the unit does not operate normally or exhibits a marked change in performance; or the unit has been dropped, or the enclosure has been damaged.

Chapter 4 - About Valves (Vacuum Tubes)

Valve (tube) types



The Phædrus Audio PHAB and PHAME preamplifiers and the PHILTER equaliser employ an EF86 pentode input valve (tube) and an ECC88, or E88CC, valve (tube) as the output device. Positions for the valves are very clearly marked on the PCB silkscreen as indicated in the illustration. The valves (tubes) that are installed in Phædrus Audio's products during assembly are selected to give the best possible performance. We offer versions of all products with NOS (rather than current production) valves. But these must be chosen carefully, and be pre-screened. Replacing the supplied valves (tubes) with different, collectible, or "high-end" valves (tubes) types may not affect any improvement and might cause deterioration of performance.

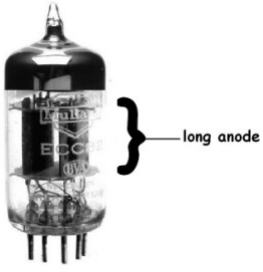
EF86

The EF86 is a low noise pentode, originally manufactured by many different factories and branded by Philips, Mullard, Telefunken, Valvo, and GEC, TESLA and Siemens/RFT. Many NOS valves are still available. Equivalents include the CV2901 (the UK service designation for the EF86) and the CV4085; a special quality version for military use. The EF86 tube is still being produced in Russia and in the Slovak Republic under JJ Electronics brand name (formerly Tesla). Chinese close equivalents are also still being manufactured.

ECC88

The ECC88 is a frame-grid, sharp cut-off, twin (dual) triode with an internal, separating screen. The valve was originally designed for service in the front ends of VHF radio receivers. The ECC88 (E88CC) tube type is equivalent to the North American 6DJ8 tubes and the (rare) military branded CV2492. The transposition of the figures from ECC88 to E88CC was Mullard's way of denoting a special quality build and is equivalent to the US 6922. Russian 6N1P tubes and the Chinese 6N1 tube are NOT equivalent. **NEVER install a 6N1(P) in the Phædrus Audio PHAB, PHILTER or PHAME product**. The ECC88 valve is sill being manufactured in China and in the Slovak Republic under JJ Electronics brand name (formerly Tesla).

12AU7 or ECC82



The 12AU7 is a popular, miniature 9-pin medium-gain dual triode valve (tube) and is used in many instrument and hi-fi amplifiers. This valve is used in both the Phædrus Audio PHI and SHUpHLER products. The 12AU7 is also known in Europe under its Mullard-Philips tube designation ECC82. This tube is widely available both new and NOS and a number of special quality equivalents are available. Current production of 12AU7 takes place in Russia,

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Slovakia, and China. Phædrus Audio selects and recommends the long anode (plate) version of the ECC82 (ECC802S) or 12AU7 valve for application in the PHI DI-Box.

Valve (tube) lifetime

You should replace the valves in the tubes in the Phædrus Audio products only when you start to notice changes in the sound quality. If the gain of the preamplifier decreases noticeably, then this is certainly evidence of the onset of valve (vacuum tube) failure. Before this, the tone may become "dull" and transients may be become "blunted".

That said, the lifetime of a valve (tube) is largely determined by the lifetime of its cathode emission and the small-signal valves (tubes) used in the PHAB, PHAME, PHILTER and SHUpHLER and PHI use oxide cathodes, which can provide adequate cathode emission for 100,000 hours or more. That's over eleven year's continuous use. So do not replace valves (tubes) just because they have seen a few years service.

Phædrus Audio Ltd. can provide suitable valves (tubes) as spares which, after a burn-in period, are screened for best performance in your Phædrus Audio product. These are available as line items:

PHAE-12AU7 – Selected 12AU7/ECC82 type valve
PHAE-ECC88 - Selected ECC88 type valve
PHAE-EF86 - Selected EF86 type valve

Please contact your dealer or Phædrus Audio Ltd. for current prices.

Chapter 5 - Instructions for use

Phædrus Audio's products employ valves (vacuum tubes) as the ONLY ACTIVE DEVICES in the audio path. Valves (vacuum tubes) and their associated circuitry need time to reach an electronic equilibrium before they will operate at optimal specifications. Please therefore allow these products to warm up for, at least, 5 to 10 minutes before using them in your signal chain. To prolong the life of your valves (tubes), it is recommended that you turn off these units when not in use.

Stereo shuffling background

Despite being discussed since the earliest days of stereophony, there remains much confusion about the term *Stereo Shuffling*. This is not surprising because the term actually refers to two, quite separate and different techniques. Simply put, the earliest use of the term (coined by no less than Alan Blumlein himself), refers to the processing of near-spaced omni' microphone signals so that they reproduce correctly on loudspeakers. The second *Shuffler* was invented some twenty years later for the processing of crossed,

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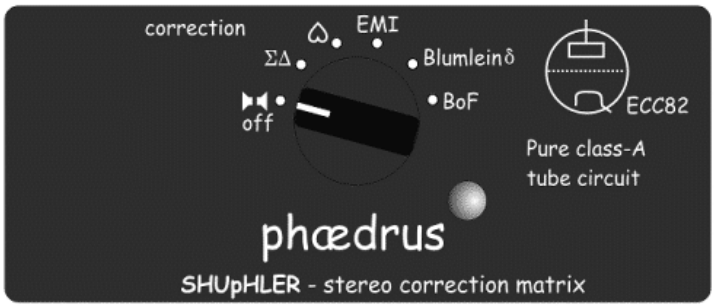
cosine (figure of eight) microphone signals to give better realism.

Why use the same name? Well the later "Shuffler" was invented by the EMI team who had worked with Alan Blumlein before he was killed in WW2. Perhaps they sought to honour him in adopting the term which derived from him? In any case, the Phædrus Audio SHUpHLER incorporates both type of historical Shuffler, plus some newer shuffling (or matrix) processes, so that you can experiment and use these amazing techniques on your own recordings.

Application and connections

The Phædrus Audio **SHUpHLER** is a line-level device which employs entirely class-A, tube circuitry for the matrix buffering and line driving. Inputs and outputs are fully transformer-coupled and earth free. The device has a high overload margin (>+18dBu at 1kHz), and low-noise, so that it's equally useable connected at insert-points, across the stereo bus/ stereo signal or used in a balanced or un-balanced send-return loop with a DAW.

Controls



Correction control

The front panel of the SHUpHLER is simplicity itself. In addition to the "off" position, five selectable shuffling techniques are available, each of which is described below.

What the *correction* switch does

This is effectively the "OFF" position. In this position, the input signals are left unprocessed and simply pass through the transformer-coupled, tube amplifiers. The electronics adds a certain "antique" feel to the sound. In this mode the SHUpHLER is a two-channel device and the two input signals need not be correlated; as they are in a stereo signal.

ΣΔ In order to accommodate the various signal manipulations inside the SHUpHLER, sum (Σ) and difference (Δ) signals are generated. Without further filtering, these signals are appropriate for decoding signals derived from *mid-side* microphone technique - a well established practice. The SHUpHLER contains the appropriate matrix to decode these signals to L/R with great accuracy. The "mid" microphone (normally a forward-facing, cardioid or omni') should feed the "LEFT (I)" input, and the "side" microphone (a cosine microphone mounted perpendicular to the audio stage)

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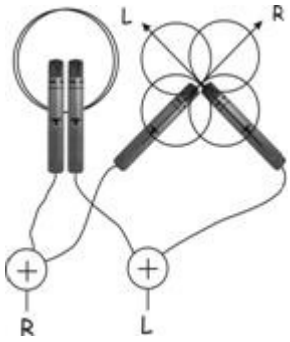
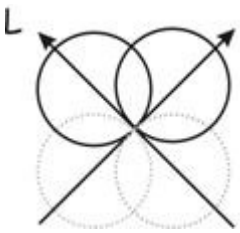
should be connected to the "RIGHT (II)" input. Depending on the phase response of the microphones, the left-right outputs *may be* reversed: only experimentation will tell. In the event of a left right swap, either re-route the signals, or reverse the direction of the cosine, "side" microphone.

The shuffling technique selected here is an entirely new technique and is intended to compensate for various shortcomings in crossed-cardioid recordings which are usually accused of lacking "spaciousness"



The directional response of a cardioid microphone is equivalent to the combination of a cosine (figure-of-eight) and omni-directional response. (In fact, the earliest cardioid microphones were made in this way). So, the signals from a crossed-pair of cardioid microphones are mathematically equivalent to those produced by a crossed pair of eights, mixed equally with a mono signal. It's not surprising this technique is often accused of lacking "spaciousness". The truth is, the only reason the crossed-cardioid technique gives reasonable results is due to the HF "beaming" of the microphones which cause high-frequency channel differences to predominate over the mono signal at higher frequencies.



One way to improve the situation is to set the microphones at a greater angle than 90 degrees, or separate them slightly, so as to add a time-delay "helper" cue, as is done in the ORTF and NOS arrangements. But, it is also possible to correct for the effect of the unwanted, omni-response electrically; and that is what is done in the SHUpHLER when the switch is in the ♥ position.

One special advantage of the electronic process is that the correction results in a suppressed rear-lobe. Because this looks like half of an eight response (see diagram), we term this technique, *Phædrus crossed-fours™*.

EMI When EMI developed the Stereosonic, two-channel, stereo recording system after the war which killed its inventor Alan Blumlein, they incorporated special circuitry which corrects for known problems with a standard stereo signal.

In naming this special circuit, its inventors (H. A. M. CLARK, G. F. DUTTON and P. B. VANDERLYN) honoured their old boss (Blumlein) in borrowing the term he had coined for an earlier stereo processor and called it the *Shuffler*. Unfortunately, this borrowing of the earlier term has led to much confusion about stereo "shuffling" over the years because a "stereo Shuffler" is actually two, quite different inventions which share a common name!

In effect what Clark, Dutton and Vanderlyn found was that, a standard, panned stereo signal (or that derived from crossed-mic's) has the drawback that, for a given position away from centre, or of the pan-pot setting away from the centre, the high-frequency components of a signal actually appear further from the centre in the reproduced "stereo-image" than do the lower frequency components. This is directly reproduced from their 1958 paper.

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Subjective tests were made with a number of observers using two loudspeakers supplied with known relative voltages from a source of recorded music. First a filter was inserted passing all frequencies up to 700 c/s from a variety of sources of sound including male and female speech, solo, orchestral and brass-band music. The experiment was repeated using all frequencies above 600 c/s. Quite definite location within about $\pm 2°$ was obtained in each case, but whereas at low frequencies the angle was in agreement with that predicted from eqns. (1) and (2) for a given loudspeaker ratio, that obtained at high frequencies was greater. The relationship obtained is in agreement with that published by other workers who rely primarily on intensity differences.[15] By introducing a factor of approximately 0·7 into the ratio $(L - R)/(L + R)$ above 700 c/s, the results for high and low frequencies can be brought into line, except for extreme positions of the source.

The circuit to introduce the 0.7 loss-factor in the ratio (R - L)/(R + L) above 700Hz is the circuit Clark and his team called the *Shuffler*. To avoid confusion, we suggest that Clark's circuit be termed the *Stereosonic Shuffler*, reserving *Shuffler* for Blumlein's original circuit (more on this later!).

The result of not utilising this Stereosonic Shuffler, on a real music signal is a "smeared" stereo image in which the high and low frequencies are not "mapped" on top of one another. The image below is an attempt to give a visual analogy for this effect in which the acoustic effect is analogous to chromatic aberration in a lens, in which the high frequency blue light is refracted differently to the low-frequency red light.

EMI's solution to this was to incorporate sum and difference circuits into the stereo bus of their famous REDD recording mixers (derived in a series of transformers) and introduce HF loss into the difference circuits so that, when matrixed back to left and right signals, the required correction had been made. As Abbey Road's technical notes for the REDD.51 mixer note,

Reference RSL.51.

Action.

The action of the Shuffler can best be explained as follows.

Suppose that an instrument is located half way between the extreme Left and the centre. When notes of very low frequency are played on this instrument all is well, but when higher and higher notes are played it appears to move out towards the left. This is due to the fact that the low frequency notes are heard substantially equally well with both ears, but the higher frequency notes are partly masked by the human head and are therefore heard better with the left ear. In this example, the Shuffler counteracts this effect by taking a little of the higher frequency signals away from the Left Hand channel and applying them to the Right Hand channel. In this way, the apparent angle of the source is made to remain constantwith increase in frequency. Thus, the Shuffler may be described as a device for producing deliberate cross-talk at the higher frequencies. Drg. REDD.C27/D1 shows that this effect is centred at 700 c/s, and that it begins to be appreciable at frequencies as low as 100 c/s.

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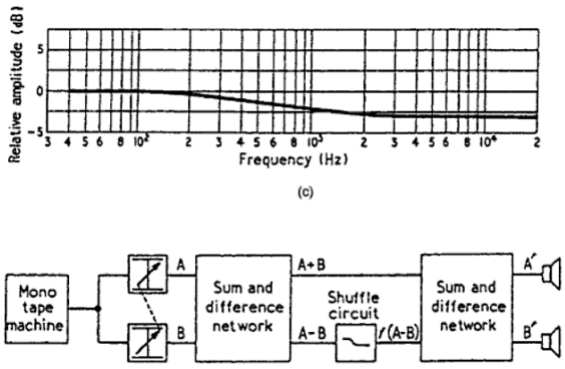
This method however has the disadvantage that the HF-loss filter-circuits require phase-correction to be applied and moreover require that the sum circuit be delayed. As Abbey Road paperwork notes,

This is accomplished by means of an all-pass network, the effect of which is to cause the overall phase angle to change from 0^0 at very low frequencies to 180^0 at very high frequencies, 90^0 of phase change being obtained at 700 c/s. It is then a comparatively simple matter to insert into the other (Sum) channel another all-pass network operating at a slightly lower frequency than the one in the Difference channel. The phase-change on both channels will then be identical, i.e., there will be no relative phase change between them. almost substantially

The result, together with the matrixing transformers, is a very expensive assembly, illustrated below.



This expense, as well as irresolvable problems of slight audio colouration due to inaccuracies in the phase-correction circuits (note the hand-written "almost" and "substantially" in the text above.), led this vital circuit to be ignored in later stereo equipment. Uncorrected stereo was reckoned to be "good enough".

It's important to point out what this actually means: that *all stereo recordings are "broken" and have been since EMI threw the last of their REDD mixers on the dumpster.* (Yes, they really did that!).

The SHUpHLER incorporates a modern (yet still completely passive) implementation of the EMI *Stereosonic* Shuffler in which the uneven frequency-response and group-delay problems of the original implementation have been entirely resolved.

Blumlein δ

The greater part of Alan Blumlein's (1933) patent is concerned with a binaural stereophonic microphone arrangement in which,

> *"two pressure microphones a1 and a2 [are] mounted [20 cm apart] on opposite sides of a block of wood or baffle b which serves to provide the high frequency intensity differences at the microphones in the same way as the human head operates upon the ears".*

Blumlein noted that, when listened to with headphones, the direct output from the microphones produced an excellent stereo effect but, when replayed through loudspeakers, the stereo effect

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was very disappointing. The transformation Blumlein required was the translation of low-frequency, inter-microphone phase differences into inter-channel intensity differences. To do this, he invented an ingenious circuit which he called the *Shuffler*. (His was the original use of the term.) A modern implementation of Blumlein's circuit is implemented within the SHUpHLER.

The advantages to the recording engineer of this technique are legion. Omnis are usually considered to sound slightly more "open" and "uncoloured" than their cardioid brothers; even as mono microphones. This is due to the acoustical devices which cardioid mic's employ to deaden the sound in the rear lobe of the directional response. Most agree that the stereo recordings with the best stereo "image" are derived from crossed cardioids or cosine (figure-of-eight) microphones. But many engineers are prepared to sacrifice stereo image just to be able to use the more natural sounding omni's. Using "Blumlein delta" (**Blumlein δ**) technique, this compromise is no longer necessary: omni's may be employed to capture pin-point sharp stereo images. The microphones should be placed about 22cm apart (not widely spaced as in conventional technique). Various baffles may be inserted between the microphones to good effect too. This technique suits various binaural and quasi-binaural microphone arrangements like the Jecklin's OSS disc, Faulkner's "Phased-array", the various spherical microphone baffles and the in-ear microphones available on the market. (In fact Blumlein saw the **δ** technique as a binaural to loudspeaker-stereo conversion process: which is what it is!)

The technique of near spaced microphones may even be extended to use near-spaced cardioids which enable very nice recordings to be made which suppress rear pick-up. In fact, even hyper-cardioids and gun microphones may be employed which permit good, full-width stereo recordings to be made of relatively distant events - something which no other technique can achieve. This has obvious applications to TV, film and live theatre and music.

BoF stands for Bride of FRANCINSTIEN which is very new shuffling technique. The BoF technique is a development of the original FRANCINSTIEN circuit which was launched during the 1990s. It is explained in detail here: http://www.richardbrice.net/i can improve.htm

Phœdrus Audio recommend that you experiment with both the **BoF** matrix and the original **EMI** matrix for processing panned-stereo recordings and for processing stereo signals derived from crossed microphones. We conjecture that, because all, practical microphones tend to "beam" and become more directional with frequency, recordings made in this way have an even greater frequency-dependant smearing effect compared with those derived entirely from pan-pots. Because the **EMI** matrix position introduces a greater degree of HF narrowing than does the newer **BoF** matrix, it may better compensate for HF beaming effects in crossed microphone recordings. However, as with all things in the art/science of recording, it's unwise to be pedantic: experimentation is the name of the game!

The table below gives our recommendations for the various SHUpHLER matrices which may be applied in various recording situations. The term "Ideal" * in the following refers only to a theoretical ideal: artistic judgments may differ.

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Type of Shuffler (or matrix)

Mic' arrangement	ΣΔ	♥	EMI	Blumlein δ	BoF	OFF
Crossed cardioids	Not suitable	Ideal*: Crossed-fours™	Good results	Not suitable	Good results	No processing
Crossed cosines	Not suitable	Possible; widens image	Ideal*	Not suitable	Good results	No processing
Pan-pot	Not suitable	Possible; widens image	Good results	Not suitable	Ideal*	No processing
Near spaced omnis	Not suitable	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Near spaced cardioids	Not suitable	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Near spaced hypercardioids	Not suitable	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Binaural microphones	Not suitable	Possible; narrow image	Worth a try!	Ideal*	Worth a try!	No processing
Phased array cosines (Faulkner)	Not suitable	Possible; narrow image	Good results	Ideal*	Good results	No processing
Wide spaced omnis	Not suitable	Not suitable	Good results	Not suitable	Good results	No processing
NOS	Not suitable	Worth a try!	Good results	Good results possible	Good results	No processing
ORTF	Not suitable	Worth a try!	Good results	Good results possible	Good results	No processing
Middle & side	Ideal*	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
Decca Tree	Not suitable	Not suitable	Good results	Not suitable	Good results	No processing

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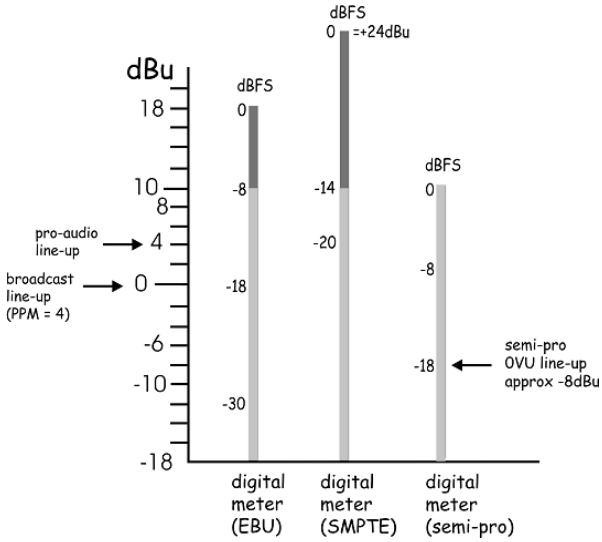
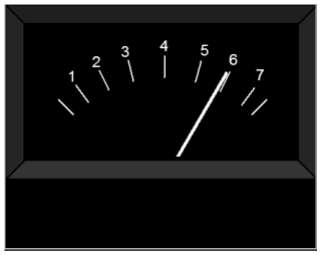
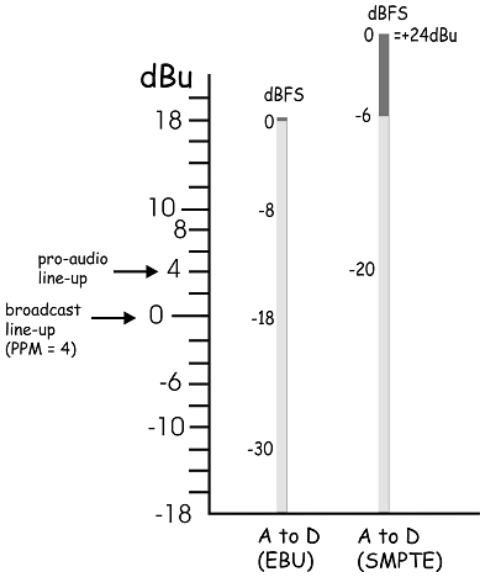
Operating levels



Because of the vintage of the SHUpHLER design, the envisaged operating level for this equipment is slightly lower than modern recording industry standards. When feeding downstream equipment, the output level should be set to a nominal 0dBu (0.775V RMS). This means that if monitoring the output on a standard VU instrument, the input attenuator should be set so that the output level reads around -4VU, with occasional peaks to 0VU on programme. On a digital meter, this is equivalent to signal peaks reading +6dB above recording industry standard +4dBu alignment level. This is equivalent to +10dBu (or -8dBFS on equipment aligned to EBU R64-1992 standard and -14dBFS on equipment aligned to SMPTE RP155 as illustrated). On a broadcast standard PPM, peaks should be set to read 6 on the BBC scale, or +8 on the European EBU scale. Output level is sufficient easily to modulate semi-pro' equipment (mixers, DAT, solid-state recorders and many sound cards) to 0dBFS.



That said, the headroom on the SHUpHLER is considerable, and no noticeable distortion is evident when operating the equipment at standard recording industry levels of +4dBu=0VU, or even higher. There is thus considerable scope for experimentation with over driving this vintage circuitry to explore its character in gradual overload. For example, peaks may be allowed to reach +18dB above alignment level without clipping. The Phœdrus Audio PHAB and the PHAME preamplifiers and the SHUpHLER matrix may thus be used directly to feed modern A to D conversion equipment aligned to EBU or SMPTE standards following the recommendations illustrated (right).



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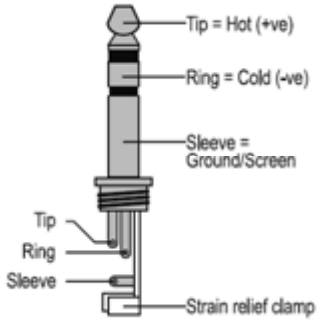
Specification

Electrical connections



Input:

Unbalanced: 0.25" Jack connector	Balanced: 0.25" Jack connector
Sleeve – Ground	Sleeve – Ground
Tip – (+) Signal	Tip – (+) Signal
Ring – Connect to sleeve	Ring – (-) Signal

Output:

Unbalanced: 0.25" Jack connector	Balanced: 0.25" Jack connector
Sleeve – Ground	Sleeve – Ground
Tip – (+) Signal	Tip – (+) Signal
Ring – Connect to sleeve	Ring – (-) Signal

SHUpHLER Specification

Circuit configuration: Two-channel, dual-valve (vacuum tube) triode design
Output: Balanced, transformer coupled, earth-free on 3-pole 0.25" jack
Maximum output level: >+18dBu @ 1kHz
Input: Balanced, transformer coupled, earth-free on 3-pole 0.25" jack
Maximum input level: >+18dBu @ 1kHz
Gain: Nominally 0dB, but approx -2dB
Frequency response: 40Hz to 15kHz, ±1dB: 15Hz to 30kHz ±3dB
Distortion: <0.2%, 1kHz @ -4VU (0dBu)
Noise: <-120dB referred to input
Power supply: 12V AC
Power consumption: 4 Watts

Phaedrus Audio Ltd. reserves the right to alter these specifications without notice.

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Declaration of Conformity

The Manufacturer of the Products covered by this Declaration is

Phædrus Audio Ltd.
head office address

The directives covered by this declaration are:

89/336/EEC Electromagnetic Compatibility directive
73/23/EEC Low Voltage Equipment directive

The products covered by this declaration are:

Phædrus Audio PHAB – microphone preamplifier; Phædrus Audio PHAME – instrument preamplifier; Phædrus Audio PHILTER – passive equalizer & tube recovery amplifier, SHUpHLER stereo correction matrix, and Phædrus Audio PHI – DI-Box.

The basis on which conformity is being declared:

The manufacturer hereby declares that the products identified above comply with the protection requirements of the EMC directive and with the principal elements of the safety objectives of the Low Voltage Equipment directive, and that the following standards have been applied:

IEC INTERNATIONAL STANDARD 60065 - Audio, video and similar electronic apparatus – Safety requirements

The technical documentation required to demonstrate that the products meet the requirements of the Low Voltage Equipment directive has been compiled and is available for inspection by the relevant enforcement authorities. The CE mark was first applied in 2011.

Signed: **Richard Brice, Technical Director**
Date: May 2011

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Appendix - TEST PRO-FORMA

Product: SHUpHLER Serial Number: _____

Tested by: _____ Tube type: _____

Gain test Pass / Fail

Distortion test: Pass / Fail

Matrix test: Pass / Fail

Frequency response test: HF (-3dB) extension: Pass / Fail

Frequency response test: LF (-3dB) extension: Pass / Fail

Phantom (+48) supply test: Pass / Fail / N/A

Listening test: Pass / Fail

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